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ABSTRACT

This report discusses findings of a study of two issues during the 1989-90 academic year at the United States Naval Academy: the removal of the Chairman of the Electrical Engineering Department, and the Superintendent's decision to give a final electrical engineering examination that might have been compromised. The study reviewed the effect of these two incidents on the faculty and examined the Naval Academy's subsequent efforts to analyze and improve the performance of midshipmen in introductory electrical engineering courses. Actions by Academy officials included reducing the amount of material covered, changing the textbooks, and trying to increase student motivation to complete homework problems. Some significant improvements in midshipman performance have already appeared, but it was not known whether this was a result of actions that have reduced the difficulty of the courses, of lenient grading practices, or both. Additional issues requiring more attention included minimum professional core competencies, the adequacy of study time, and extra instruction for midshipmen having academic difficulty. Appendices include background information concerning the EE312 final examination, Naval Academy efforts to improve midshipmen performance in electrical engineering, and background events leading to the removal of the Electrical Engineering Department Chairman. Recommendations are provided. (GLR)

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United States General Accounting Office

GAO

Report to Congressional Requesters

July 1991

NAVAL ACADEMY

Low Grades in Electrical Engineering Courses Surface Broader Issues

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United States
General Accounting Office
Washington, D.C. 20548

National Security and
International Affairs Division

B-240866

July 22, 1991

The Honorable Sam Nunn
Chairman, Committee on
Armed Services
United States Senate

The Honorable John Glenn
Chairman, Subcommittee on
Manpower and Personnel
Committee on Armed Services
United States Senate

In response to your request, we reviewed two incidents involving the faculty and the administration of the U.S. Naval Academy during the 1989-90 academic year: the removal of the Chairman of the Electrical Engineering Department and the Superintendent's decision to give a final electrical engineering examination that might have been compromised. We reviewed the effect on the faculty of these two incidents and the Naval Academy's subsequent efforts to analyze and improve the performance of midshipmen in introductory electrical engineering courses.

Background

The Chief of Naval Operations has issued guidance on the minimum professional core competencies required of newly commissioned officers, regardless of commissioning source. The Naval Academy's implementation of this guidance requires all midshipmen to take electrical engineering courses. Midshipmen fulfill this electrical engineering requirement by taking one of three series of courses: one for midshipmen majoring in electrical engineering, one for those who are majoring in another engineering discipline, and a third for midshipmen who are not engineering majors.

The two-semester introductory electrical engineering courses for midshipmen not majoring in electrical engineering have been characterized by an unusually high percentage of unsatisfactory grades for nearly a decade. In the 1989-90 academic year, almost half of the midshipmen taking one of the introductory electrical engineering courses received unsatisfactory grades. Subsequently, the Academic Dean and the Director of the Division of Engineering and Weapons became concerned about the poor performance in these courses. When interim grades were determined for the second-semester follow-on courses, the grades were

still below what the administration considered acceptable. Consequently, the electrical engineering faculty was told to raise the grades in these courses.

On February 23, 1990, the day after he refused to raise grades in one of the courses that was part of an accredited engineering program, the Chairman was removed from his position.[1] The former Chairman believes that his removal stemmed from his refusal to raise grades. The Academic Dean told us he had removed the Chairman because he believed new leadership was needed to improve midshipman performance in electrical engineering.

In May 1990, the offices of two electrical engineering faculty members were broken into by a person or persons unknown. The faculty and the Academic Dean, concerned that a final examination might have been compromised, wanted to delay the exam so a new version could be developed. The Superintendent, citing his faith in the Academy's honor system, decided to give the original exam as scheduled. Various analyses have found no evidence of any mass cheating.[2]

Results in Brief

Several Naval Academy faculty members told us that concerns about grading pressure have had a negative effect on morale. Faculty members have asked for and received assurances that in the future grading would be the responsibility of only the faculty.

Academy officials believe that they have thoroughly analyzed the midshipman performance problems in electrical engineering courses and have developed effective remedies. Actions included reducing the amount of material covered, changing the textbooks, and trying to increase student motivation to complete homework problems. Their position is that, while it will take some time for the full effects of the changes to show up, significant improvements in midshipman performance have already appeared. Academy officials believe that improvements in midshipman and faculty attitudes have played a key role.

Grades in the introductory electrical engineering courses have improved. However, it is not clear what this trend represents—whether real

[1]Since the former Chairman was a tenured civilian faculty member, he has continued to teach at the Academy.

[2]It should be noted that there is no statistical way of reliably determining whether a small number of individuals cheated solely through examination of test scores.

improvement in midshipman performance has occurred, is the result of actions that have reduced the difficulty of the courses and of lenient grading practices, or both.

We believe that four issues merit more attention:

- the consistency of the policies of the various commissioning programs regarding courses required as evidence that prospective officers possess the minimum professional core competencies in electricity and electronics,
- the evaluation of the effectiveness of the initiatives designed to improve midshipmen performance in the introductory electrical engineering courses,
- the adequacy of study time available to midshipmen, and
- the regulations governing the midshipmen activities, particularly the priority of academic activities, when scheduling conflicts arise.

Faculty Morale Has Been Affected by Administration's Actions

According to several Naval Academy faculty members, the actions by the Academy administration have resulted in an environment in which a number of faculty members feel their role in academic matters has been inappropriately infringed upon by the administration. The Superintendent has assured the faculty that he supports the authority of the faculty to award grades as it sees fit and has requested that a faculty committee draft a policy to this effect. The Academic Dean has accepted the committee's proposed policy statement, and it is currently being incorporated into existing Naval Academy instructions.

Despite the Superintendent's assurance, some electrical engineering faculty members have expressed concern that tenure decisions and performance ratings may be affected by the grades they give. This concern is based on their perception that the administration is preoccupied with grades rather than with midshipman academic performance. Faculty members told us that they believed that job security for nontenured civilian faculty could rest on the average grades given.

Results of Initiatives to Improve Performance Have Been Inconclusive

In the wake of the low grades received by numerous midshipmen in the introductory electrical engineering courses, the Academy initiated changes in the fall semester of the 1990-91 academic year aimed at improving midshipman performance. These changes included shifting some course material for the nonengineering majors' course sequence to the second semester and deleting some material from the second

semester course, using an easier textbook, reducing the number of homework problems, and composing the final examinations exclusively of previously assigned homework problems.

In the 1990-91 academic year, grades in the introductory electrical engineering courses were higher than they had been in recent years. However, several of the changes, such as reducing the amount of material covered and basing exams on homework problems, have served to make the courses less difficult than they were in the past. Also, we found that the faculty used lenient grading practices, such as going below the established cut points for grades and offsetting low exam scores with higher grades from more subjective grading components like lab grades and class participation. The combination of these two factors raises questions about whether the 1990-91 grade distribution can legitimately be compared to those of prior periods.

Additional Issues Merit More Attention

The reviews that provided the basis for the changes focused on the specific electrical engineering courses. They did not focus on the overall electrical engineering program or other factors that had been suggested by faculty and others as affecting midshipmen's academic performance. One review found that one reason suggested for the poor performance in the introductory electrical engineering courses was that many midshipmen majoring in other academic areas did not see electrical engineering as relevant to them.

A review by a committee of educators recommended that the Electrical Engineering Department examine the minimum professional core competencies in light of current and future needs of the Navy. Academy officials told us that, as part of a recent curriculum review, they had reevaluated their requirement that nonelectrical engineering majors take electrical engineering and concluded that it was appropriate. However, they did not examine other options for satisfying the minimum professional core competencies in electricity and electronics. The Academy is the only one of the primary commissioning programs that requires electrical engineering courses to fulfill those core competencies. The other commissioning programs, which provide about 85 percent of the newly commissioned officers, allow other courses (such as calculus-based physics) to satisfy this requirement.

Another issue that deserves more consideration is the adequacy of study time. The general perception among midshipmen and faculty is that midshipmen do not have enough study time for their courses in light of the

other Academy demands on their time. Our 1990 survey of midshipmen and faculty showed that about half of the midshipmen and a majority of the faculty who responded believed that midshipmen did not have adequate study time. The Academy, however, did not explicitly address the issue of the adequacy of study time in its actions dealing with the problem of electrical engineering grades. It has, however, taken some actions aimed at increasing the time available for study.

Another area we believe should be addressed is the relatively low priority placed on extra instruction for midshipmen having academic difficulties. Current Midshipmen Regulations, addressing the priority of activities in case of schedule conflicts, place attending extra instruction sessions next to last in a list of 24 activities, following such activities as intramural athletic activities and parades. The same priority guidelines apply to all midshipmen, whether academically deficient or not.

Recommendations

We recommend that the Secretary of the Navy direct the Chief of Naval Operations to determine whether the implementation by the various officer commissioning programs of the minimum professional core competencies in electricity and electronics are consistent and comply with the guidance.

We also recommend that the Secretary of the Navy direct the Superintendent of the Naval Academy to

- explore the potential for satisfying the required minimum competency in electricity and electronics with other courses already in the core curriculum,
- conduct a more systematic evaluation of the effectiveness of the initiatives implemented to improve the performance of midshipmen in the introductory electrical engineering courses, and
- conduct an evaluation of the emphasis placed on academic activities in relation to military and physical activities. Such an evaluation should at a minimum include a review of the adequacy of study time and a review of the placement of extra instruction in the order of priorities outlined in the Midshipmen Regulations to ensure that they reinforce the Academy's emphasis on academics.

Scope and Methodology

We performed our review at the U.S. Naval Academy in Annapolis, Maryland. We reviewed available documentation, interviewed knowledgeable officials and faculty members, and analyzed midshipman

grades. In addition, as part of a broader review, we administered surveys to a sample of 528 midshipmen (projectable to at least 76 percent of the total midshipmen) and 122 faculty members (projectable to at least 66 percent of the total faculty) in the fall of 1990. The surveys covered a range of student-related subjects, including students' study time. From the survey data we collected, we computed sampling errors for each of the survey questions presented in appendix III. We present the response percentages in tables III.3 and III.4, along with the sampling error for each percentage. When added to and subtracted from the response percentages, the sampling errors provide a 95-percent confidence interval for each question.

We conducted our review from May 1990 to April 1991 in accordance with generally accepted government auditing standards. We discussed a draft of this report with Academy and Department of Defense officials and incorporated their comments as appropriate.

The detailed results of our work are contained in the appendixes to this report. Appendix I describes the events surrounding the removal of the electrical engineering Chairman. Appendix II describes the events surrounding the possible compromise of an electrical engineering final exam. Appendix III describes the Academy's efforts to analyze and improve the performance of midshipmen.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 15 days from its date of issue. At that time, we will send copies to other interested congressional committees and Members of Congress, the Secretaries of Defense and the Navy, and the Superintendent of the Naval Academy. We will also make copies available to other interested parties on request.

This report was prepared under the direction of Paul L. Jones, Director, Defense Force Management Issues. If you or your staff have any

questions concerning this report, he can be reached on (202) 275-3990. The major contributors to this report were William E. Beusse, Assistant Director; Martha J. Dey, Evaluator-in-Charge; and Sharon L. Reid, Regional Assignment Manager.

Frank C. Conahan
Assistant Comptroller General

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Abbreviations

CNO	Chief of Naval Operations
DOD	Department of Defense
EE	Electrical Engineering
NIS	Naval Investigative Service
OCS	Officer Candidate School
ROTC	Reserve Officer Training Corps

Background and Events Surrounding the Removal of the Electrical Engineering Department Chairman

All Midshipmen Are Required to Take Courses in Electrical Engineering

The Chief of Naval Operations (CNO) has issued guidance on the minimum professional core competencies for officer accession programs, including the Naval Academy, Reserve Officer Training Corps (ROTC), and Officer Candidate School (OCS) programs. Part of this guidance requires that prospective officers be able to comprehend and apply the principles of electricity and electronics. The Naval Academy requires electrical engineering courses to meet the professional core competencies required of all Navy junior officers. The ROTC program allows this requirement to be met by other kinds of courses. The OCS program does not impose any academic program requirements on its officer candidates other than completion of an undergraduate degree. According to a Department of Defense (DOD) official, graduates of the Navy's primary commissioning programs are assigned without regard to source of commission.

Midshipmen fulfill their electrical engineering requirement by taking one of three sequences of courses, as shown in table I.1. Midshipmen majoring in fields other than engineering take Electrical Fundamentals and Applications I and II (EE311/EE312). Midshipmen majoring in engineering fields other than electrical engineering take Electrical Engineering I and II (EE331/EE332). Midshipmen majoring in electrical engineering take a series of more advanced courses beginning their second year at the Academy. The courses for midshipmen who are not electrical engineering majors are the ones of concern.

Table I.1: Electrical Engineering Courses

Majors	Courses	When taken
Electrical Engineering (EE)	Series of courses	Sophomore year through senior year
Engineering, other than EE	EE331/EE332	Fall/spring, junior year
Nonengineering	EE311/EE312	Fall/spring, junior year

Grades and Grading Policy

Grades affect the status and privileges of midshipmen at the Academy. They are the major determinant of class standing, which establishes a midshipman's priority in service selection and seniority upon graduation and commissioning. A midshipman's grade point average accounts for about 70 percent of his final class standing. The Academy uses a letter grading system with quality points assigned from 4.0 for an A to 0.0 for an F. To graduate, a midshipman must achieve a C average (a grade point average of 2.0).

Within the academic community, it is a commonly accepted professional standard that determination of grades is solely the province of the teaching faculty. According to the American Association of University Professors, faculty should have the responsibility for the assignment of grades, and no grade should be assigned or changed without faculty authorization. The Naval Academy, like many other undergraduate institutions, had no written policy clearly defining the roles of the administration and the faculty in determining grades.

Administration's Actions Regarding Low Grades

During the 1989 fall semester, about 49 percent of the 607 midshipmen taking the basic-level introductory electrical engineering course (EE311) received unsatisfactory grades—about 21 percent received an F, and about 28 percent received a D. During the same semester, about 38 percent of the 382 students in the second-level course (EE331) received unsatisfactory grades—about 11 percent received an F, and about 27 percent received a D.

As a result, in December 1989, the Academic Dean and the Director of the Division of Engineering and Weapons (who oversees the Electrical Engineering Department and four other engineering departments) reviewed the fall semester final grades in EE311 and EE331 to determine why so many midshipmen had received poor grades. Initially, they focused on whether they could do anything about the low grades.

The Division Director asked the Department Chairman to have the instructors review the final examination grades and consider curving the semester averages even more. The Chairman told him that the instructors, at their own initiative, had already adjusted the course grades to make the passing grade 55, rather than 60. According to the Chairman, the 12 instructors teaching the 26 sections of the EE311 course again reviewed the exam and confirmed that it fairly represented the course material, had not been overly difficult, and had not been too long.

The Division Director reviewed the final exam on his own and agreed that it seemed fair. The Division Director's review recognized two factors that should have made the exam easier for the midshipmen: (1) it consisted entirely of homework problems that had been assigned during the semester, and (2) one question, worth 5 percent of the exam grade, had been given to the students before the examination. According to course instructors, only half of the students had attempted this question.

Faculty Told to Raise Grades

During the 1990 spring semester, the Academic Dean and the Division Director closely monitored the performance in both introductory level engineering courses (EE312 and EE332). Six weeks into the semester, the average of grades in EE312 was 1.9. According to the Academic Dean, he met with the Division Director and the Department Chairman and agreed to rescaling the grades in EE312. He then met with the EE312 faculty on February 15, 1990, and told them that the average grade indicated a performance that was too low. After being pressed to provide a range, he told them that a class grade point average of 2.3 plus or minus 0.1 was acceptable.

The Division Director sent a memorandum dated February 19, 1990, to the Department Chairman directing that the grade point average "be raised by shifting the higher D's and F's up . . . since those are obviously the two grades that are getting all the attention. I know this is distasteful to you, but. . . . Let's just do it and be done with it." Accordingly, the 6-week grades were raised from a class grade point average of 1.9 to 2.21.

On February 21, 1990, the Division Director sent a memorandum to the Superintendent through the Academic Dean that discussed initiatives for improving grades in the introductory courses. The memorandum, which noted that most of the changes would take place in the fall semester of the 1990-91 academic year, stated, "At that time the grades should fall into a respectable range; until then, the grades of EE312 and EE332 will be 'curved' as necessary to insure that they are acceptable."

The 6-week class grade point average in the second-level engineering course (EE332) was also below C. The Department Chairman was told that the grades in the course had to be reviewed by the Academic Dean prior to their becoming official. The Chairman received a memorandum from the Division Director on February 22, 1990, explaining this requirement: "In regard to the EE332 grades . . . . It's important that they go through this review prior to becoming official, because both courses are getting the same scrutiny. I'm sure the same acceptable range applies: 2.20-2.30."

According to the Department Chairman, he refused to raise the grade point average from 1.8 because EE332 was part of an accredited engineering major and arbitrarily raising the grades would compromise the

integrity of the course.[1] The Department Chairman said he asked the Academic Dean to put the order to raise the grades in writing, and when the Academic Dean refused, the Department Chairman refused to curve the grades.

The Academic Dean told us that the grades had already been released to the midshipmen, making it too late to change them, and that the directive to raise grades in EE332 had been issued without his knowledge. He said he had never intended that EE332 grades be raised. However, although he and the Superintendent had been informed of the intent to curve EE332 grades, they took no action to rescind the directive.

Academic Dean Removed the Department Chairman After He Refused to Resign

On February 23, 1990, the Academic Dean asked the Department Chairman to resign from the chairmanship. When the Department Chairman refused, the Academic Dean removed him from the position. The Chairman said the Academic Dean had told him that he had an hour to come back with "a fix for the problem" and he would be reinstated. The hour passed, and the Department Chairman did not return.

The Academic Dean then sent an Associate Dean to talk to the Department Chairman. According to the Associate Dean, he advised the Department Chairman to change the grades and offer to work with the Academic Dean. The Academic Dean said he met with the Department Chairman in the afternoon and the Chairman continued to take no responsibility for the problem and blamed the poor performance on such factors as poor attitudes among midshipmen and the occurrence of the final exam right after Army-Navy week. The Academic Dean then officially removed him from the chairmanship. The Academic Dean appointed a military instructor to act as Chairman of the Electrical Engineering Department. The former Chairman, a tenured civilian professor, continues to teach at the Academy.

The former Chairman believes he was removed from the chairmanship because he refused to raise the EE332 grades. The Superintendent and the Academic Dean told us that the Chairman's removal was not the result of his refusal to raise grades. The Academic Dean said that he had removed the Department Chairman because of his unwillingness to

[1]The Naval Academy is accredited by the Middle States Association of Colleges and Secondary Schools (Middle States Association). In addition, engineering majors are accredited by the Engineering Accreditation Commission of the Accreditation Board of Engineering and Technology. EE331 and EE332 are part of an accredited engineering major. EE311 and EE312 are not courses in an accredited engineering major.

accept responsibility for the problem or to recognize that the electrical engineering faculty's performance and attitude could be a cause. The Academic Dean told us that he believed new leadership was required to improve the midshipman performance in electrical engineering. He stated that the grades in EE332 were not raised, even after the Chairman was replaced.

Academy officials also told us that, despite how the memoranda, the frequent meetings with the Department Chairman, and the meeting with the faculty may make it appear, it was never their intention to pressure the faculty to raise grades arbitrarily. According to the Academic Dean, the purpose was to address the problem of midshipmen not performing to the level expected of them.

The Faculty Has Requested a Formal Policy on Grading

Attempts to limit the number of low grades have occurred before. In 1963, the Naval Academy abolished a numerical grading system in favor of an alphabetical system. Within a year, the number of midshipmen with unsatisfactory grades increased significantly. Subsequently, the administration established limits on the number of midshipmen to receive Ds and Fs. After the press reported on the limits, the Academy appointed a committee to review the practice. The committee recommended eliminating the limits, even though it believed that the overall attrition rate could increase. The committee believed performance would improve once midshipmen realized that poor academic performance would result in dismissal. In 1966, the Middle States Association disapproved sharply of the grade limits or quotas. The Superintendent abolished the practice in the fall of 1966. However, no policy detailing the authority of the faculty and administration with regard to grading was ever established.

Following the administration's actions regarding the electrical engineering grades in 1990 and the removal of the Department Chairman, faculty members asked the administration for assurances that in the future, grading would be the responsibility of only the teaching faculty. In late May 1990, the Superintendent addressed the faculty and told them that he supported the independent authority of the faculty to award grades as it saw fit. He also asked the Civilian Faculty Affairs Committee to draft a policy statement on the issue. The Committee presented its proposed policy statement on grading to the Academic Dean on March 8, 1991. It explicitly states that "the instructor of a course has the sole authority for assigning grades in that course." The

Academic Dean accepted the proposed policy statement, and it is currently being incorporated into existing Naval Academy instructions.

Background and Events Surrounding the EE312 Final Examination in the 1990 Spring Semester

On May 6, 1990, a faculty member discovered that the offices of two electrical engineering instructors had been broken into. The offices were located on separate hallways, and entry was gained by breaking the cylinders to the doorknobs. One office contained 80 copies of an EE312 final exam. Because no items had been taken from the offices, the faculty members thought that the break-in might have been an attempt to obtain a copy of the exam. In fact, one exam was folded back at the corners as if it had been examined and perhaps photocopied.

The faculty members, fearing that the exam might have been compromised, decided that developing a new exam was appropriate, and they requested a 2-day delay to make up a new test. A Naval Academy instruction states that the scheduled time of a final exam may not be changed without the prior approval of the Academic Dean. The faculty approached the Academic Dean and obtained his support for delaying the administration of the exam. The Superintendent, however, insisted that the exam be given as scheduled. His rationale was that the Naval Academy has an honor system, which prohibits midshipmen from lying, cheating, or stealing, and he had faith that the midshipmen would not cheat. On May 7, 1990, the test was given as originally scheduled to about 500 midshipmen.

Naval Investigative Service Investigation of the Break-in Proved Inconclusive

When they discovered the break-in, faculty members notified the Naval Investigative Service (NIS), which began its investigation the same day. As part of its investigation, NIS obtained a tape from the video surveillance system in the building where the faculty offices were located. The tape showed two people entering the building after hours, but the quality of the video was too poor to identify the individuals.

At NIS's request, 15 electrical engineering instructors, all 36 company officers,[1] the midshipman brigade commander[2] and his assistants, and 34 second class midshipman honor representatives viewed the video in an attempt to identify the individuals on the tape. Although there were no positive identifications, the names of midshipmen with characteristics similar to those of the individuals in the video were provided to NIS and the Legal Advisor to the Commandant. On the basis of an anonymous Academy computer mail message and an anonymous telephone call, other midshipmen were identified as potential suspects.

[1]Commissioned officers who advise, supervise, and oversee midshipmen's company activities.

[2]The senior midshipman who commands the brigade.

NIS investigators interviewed, photographed, and fingerprinted 27 midshipmen, including the midshipmen identified in the anonymous tips or listed as having similar characteristics to those in the video. NIS investigators also tested the doorknobs and the 80 copies of the exam for latent fingerprints. The only identifiable prints were found to belong to the faculty member whose office had been broken into. On September 14, 1990, NIS closed its investigation, without determining who had been involved in the break-in.

Analysis of Test Scores Revealed No Evidence of Mass Cheating

According to an NIS investigator, because of the media attention that the break-in had received, the NIS investigators requested that the staff of the Naval Education and Training Command conduct a statistical comparison analysis of the exam scores and other grades from the EE312 course to look for variations in the exam scores. This analysis revealed no evidence of mass cheating on the exam. According to the Division Director, the EE312 faculty, having performed their own analysis of the grades, agreed that mass cheating had not occurred. It should be noted, however, that, while such analyses of exam scores are capable of detecting the existence of mass cheating, there is no statistical way to reliably detect individual instances of cheating solely through examination of test scores.

Our analysis of the exam scores also showed no evidence of mass cheating. We found that 62 percent of the midshipmen taking the exam scored lower on it than they had on the earlier ones.

Naval Academy's Efforts to Analyze and Improve the Performance of Midshipmen in Electrical Engineering

Several Analyses of Midshipmen's Performance in Electrical Engineering Courses Conducted

There have been a variety of analyses aimed at determining the reasons for the poor performance of midshipmen in the core electrical engineering courses. Before his removal, the former Chairman of the Electrical Engineering Department discussed a number of factors with the Division Director. In the spring of 1990, the Chief of Naval Operations had a member of his Executive Panel conduct an independent assessment, and a committee of Naval Academy and external engineering educators formed at the direction of the Superintendent conducted another review of the introductory electrical engineering courses. Finally, the Academy's accrediting agency, the Middle States Association of Colleges and Secondary Schools, conducted a broader study of Academy issues, which also focused on the introductory electrical engineering courses.

Former Department Chairman's Review

During December 1989, the Division Director met regularly with the Department Chairman, who, after reviewing the basic-level electrical engineering introductory course (EE311), suggested several initiatives to improve the performance of midshipmen.

The Chairman and the Division Director identified a number of factors they believed could have contributed to the EE311 problem. Among the potential factors they identified were the following:

- A relatively inexperienced and low-ranking group of faculty members taught the course in comparison with most other third-year engineering courses.
- New faculty were inadequately indoctrinated (particularly the military instructors who arrived only shortly before they had to begin teaching).
- The course was perhaps attempting to teach too much material and covering essentially the same material as the course aimed at engineering and physics majors (in fact, the EE311 course used the same textbook as the higher level course).
- Many of the course instructors perceived that the goal of most midshipmen in the course was just to pass.
- Midshipmen's preparation for the exams appeared to be inadequate, with few taking advantage of the extra instruction that was available.
- Instructors did not uniformly require the submission of homework; nor did they always grade and return it. Consequently, homework was frequently not done.
- Electrical engineering instructors felt that inadequate skills in foundation courses, such as algebra and physics, were sometimes greater contributors to poor performance than the electrical engineering concepts themselves.

On January 2, 1990, the Division Director wrote a memo through the Academic Dean to the Superintendent outlining these factors and identifying a number of recommended solutions. Among the recommendations were

- improving the indoctrination and monitoring of new faculty;
- determining whether more experienced, higher ranking faculty could be assigned to teach the course;
- appointing a committee headed by a professor knowledgeable in electrical engineering and the core curriculum to review the course content;
- having instructors require the submission of homework as part of the course grade to help the midshipmen learn progressively instead of relying on "cramming";
- requiring instructors to pass out homework solutions to act as study guides;
- exploring the possibility of weekly mandatory tutorial sessions; and
- administering basic skill tests to determine whether prerequisite preparation was adequate.

Review by an Adviser to the Chief of Naval Operations

In March 1990, the Chief of Naval Operations asked a member of his Executive Panel, who is an electrical engineering professor and was dean of a school of engineering, to conduct an independent assessment of the situation in the Electrical Engineering Department. He reported to the Chief that he was favorably impressed with the positive attitude of all concerned, and he concurred with the immediate and long-term initiatives to put the electrical engineering program back on track. He noted that it would be some time before changes in the academic arena would show tangible results and that one of the more difficult tasks would be to rebuild the trust between the administration and the faculty.

Review by a Committee of Educators

After the removal of the Department Chairman, representatives of the Civilian Faculty Affairs Committee met with the Superintendent to add their endorsement to a request made by the electrical engineering faculty for an independent review of the teaching environment. These representatives told us that the Superintendent had said that he wanted an internal review group to look only at electrical engineering. The Superintendent stated that he was interested in a more rapid response than an external group looking at the total teaching environment could provide.

In April 1990, the Superintendent directed a committee of educators to review the electrical engineering courses. The committee was composed of seven educators—two from the Naval Academy, three (including one Navy officer exchange instructor) from other federal service academies, and two from civilian universities. Before the committee met, members were provided with background materials consisting of curricula for the introductory electrical engineering courses (EE311/EE312 and EE331/EE332); the minimum professional core competencies of the CNO; Professional Competency Objectives, which set the course standards; and plots of grades for the courses.

In May 1990, the committee convened at the Naval Academy for 2 days, a total of 15 hours. A charge given the committee by the Superintendent, the Academic Dean, and the Division Director in their introductory remarks was to look at the electrical engineering courses for nonmajors. Because of time constraints, the committee restricted its inquiry to the basic-level introductory courses (EE311/EE312). According to a committee member, the committee spent 5 of its 15 hours receiving instructions from the Academy administration and briefing the administration on its preliminary findings the next day. During the remaining 10 hours, the committee interviewed four midshipmen who had just completed the EE311/EE312 sequence, the former Chairman and an Associate Chairman of the Electrical Engineering Department, the faculty member who had served as the EE312 Course Coordinator, and an EE311/EE312 instructor. During this time the committee also prepared the exit briefing for the administration.

The committee presented its six pages of findings, conclusions, and recommendations on June 5, 1990. Its recommendations basically agreed with those that the Division Director and former Chairman had arrived at in December 1989. It concluded that the topics taught in EE311 and EE312 met the Navy's minimum professional core competencies as established by the CNO, but only barely. It found no unnecessary topics and none that were covered in too much depth. However, the committee found that the minimum professional core competencies in electrical engineering required an understanding not normally required of nonengineering students and recommended that the minimum professional core competencies be reviewed. The committee noted that midshipmen were apprehensive about their success in the introductory electrical engineering courses and reports of attitudes expressed by instructors have had a negative effect on midshipmen's learning. The committee agreed with the former Department Chairman's recommendation to change textbooks and reduce the amount of material covered in

EE311. The committee also recommended that the Electrical Engineering Department have close and frequent contact with the Mathematics and Physics Departments, provide more training for new instructors, and seek ways to make the courses as relevant and interesting as possible without compromising the major goal of learning electrical engineering principles. The committee concluded that the process for assigning grades was "rational, fair, and tough" and noted that "...There must be a recognition by the administration that, provided grades are arrived at fairly and by rational means . . . their assignment is the province of the faculty."

Accrediting Agency's Review

Faculty members of the Electrical Engineering Department wrote to the Middle States Association in April 1990 stating that the Academy's administration had pressured the faculty to lower its academic standards and assign higher grades than the midshipmen deserved. The Association, referring to the allegations as "serious charges," requested an account from the Academy administration. The Academy provided an account in May 1990, and in the next month the Association informed the Academy that representatives from the Association would visit the Academy to discuss the alleged complaint and get more information.

Two representatives from the Association visited the Academy on November 19, 1990, and discussed with Academy officials a number of issues, one of which was the electrical engineering program. The results of the Association's review are expected to be issued in July 1991.

Implementation of Changes to Improve Midshipmen's Performance

In the fall of 1990, the Academy implemented five changes intended to improve the performance and grades of midshipmen taking introductory electrical engineering. These initiatives, which are similar to the recommendations of the former Department Chairman, were as follows:

- Shift part of the course material from the first semester to the second semester and drop some material from the second semester; in effect, teach the course at a slower pace and cover less material.
- Replace the course textbook, which some faculty and administrators considered too difficult, with one they considered easier.
- Reduce the number of assigned homework problems and compose about 20 percent of the tests and all of the final examination from previously assigned problems, thereby increasing the motivation of the midshipmen to do the homework.

- Improve the training course for new instructors and increase the number of more experienced and higher level faculty teaching the core courses.
- Increase the availability of extra instruction.

According to the Division Director, although these initiatives were primarily directed at the basic-level introductory electrical engineering courses (EE311/EE312), some of these changes were also made to second-level introductory courses (EE331/EE332). In EE331, for example, the textbook was also changed to one that the faculty considered easier. There was, however, no shifting of material in the second-level course from the first to the second semester, and the number of assigned homework problems was left to the discretion of individual instructors.

The Division Director stated that the efforts to improve the training of new instructors and increase the availability of extra instruction were implemented throughout the Electrical Engineering Department. With regard to the last initiative, faculty members in the department contend that extra instruction was always available to any midshipmen desiring the help, but few midshipmen chose to take advantage of its availability. The Academic Dean stated that, while the extra instruction was available, it was not encouraged. In fact, he said several faculty members were openly antagonistic to midshipmen, thereby discouraging participation in extra instruction.

According to Academy officials, the Academy also implemented several other changes as a result of the review by the committee of educators. These included increasing the coordination between the faculty of the Electrical Engineering Department and the faculties of the Mathematics and Physics Departments. Representatives from the Electrical Engineering Department met separately with those department representatives in the fall of 1990 and discussed the prerequisite knowledge required to perform well in electrical engineering.

Academy officials indicated that, while it will take some time for the full effects of the changes to show up, significant improvements in midshipman performance have already appeared. They believe that improvements in midshipman and faculty attitudes have played a key role.

Electrical Engineering Grades Have Improved, but Reasons for Improvement Are Unclear

Following the changes instituted in the fall of 1990, the grades of midshipmen taking the electrical engineering courses showed improvement. Of the midshipmen taking the basic-level introductory electrical engineering course (EE311), 27 percent received unsatisfactory grades, compared to 49 percent the previous year. Also, 29 percent of the midshipmen taking the second-level introductory course (EE331) received unsatisfactory grades, compared to 39 percent the previous year.

Although this data implies that student performance in electrical engineering has improved, the extent of improvement may not be as great as the figures would suggest. One reason for this caveat is that several of the changes, in effect, made the courses less difficult—for example, the shifting of some course material to the second semester. Faculty members told us that, while there had been no such shift in EE331, the courses were not as demanding of midshipmen as they had been in previous years. In addition, according to course instructors, the Division Director had reviewed the EE311 final exam before it was given, and every effort was made to ensure that it was "do-able" by the midshipmen.

A second reason for questioning whether the higher grades represent real improvement is the faculty's lenient grading, which resulted in some midshipmen receiving higher letter grades than their numerical grades warranted and some receiving a passing grade without having passed any of the exams.

The grade point scales established by the faculty for the two courses are shown in table III.1. While EE331 used a traditional 10-point grading scale, EE311 used a more expanded one. In addition, the faculty agreed to allow adjustments of 2 points above or below their agreed upon cut-off point for each letter grade. This meant, for example, that, while the cut-off point for an A in EE311 was 86, a midshipman in one section with an 84 could receive an A, and a midshipman in another section with an 87 could receive a B.

Table III.1: Grading Scales Used for EE311 and EE331

	Numerical grade range	
Letter grade	**EE311**	**EE331**
A	86 and above	90 and above
B	76 to 85	80 to 89
C	65 to 75	70 to 79
D	55 to 64	60 to 69
F	below 55	below 60

Although the faculty members agreed on these grading scales, they did not strictly follow them. The faculty gave higher grades to 77 midshipmen than their numeric averages warranted. In EE311, the faculty went below the cut-off points between grades and gave higher grades in 45 cases (7 percent). In two instances, the faculty went five points below the cut-off points; a midshipman with a semester average of 50 received a D in the course, while another midshipman with a semester average of 71 received a B. In EE331, the faculty went below the cut-off points in 32 cases (12 percent) and gave the higher grades. In one instance, an instructor went nine points below the cut-off point, and a midshipman with a semester average of 81 received an A in the course.

Final semester grades are based on several components: test scores, lab performance, and instructor input. These components, along with their percentage weights for EE311 and EE331, are shown in table III.2. In both courses, the lab performance and instructor input grades are subjective and left to the individual faculty member's discretion. Also shown in table III.2 is the average score given for each grading component. The average scores given for "Lab" and "instructor input" in EE331 were not available. However, we calculated that, since their inclusion had resulted in an increase in the average semester grade from 69 to 73, the combined average of these components was about 80.

Additionally, in the cases of 31 midshipmen (11 percent), final semester averages were higher than any one of their test scores. For example, one midshipman with test scores of 33, 33, 69, and 66 for a semester average of 56 ended up with a final semester average of 71 after the inclusion of the lab and instructor input. This means that this midshipman averaged about 99 on these more subjective components. We found that this instructor flexibility had resulted in 29 midshipmen (5 percent) passing EE311 without having passed any of the examinations.

Table III.2: Components of Semester Grades and Average Scores for Fall 1990 Semester

Course	Component	Component percentage	Average score
EE311	6-week test	20	70
	12-week test	20	58
	Final test	35	67
	Lab	10	86
	Instructor input	15	82
EE331	6-week test	10	65
	12-week test	10	63
	16-week test	10	76
	Final test	35	70
	Lab	20	[a]
	Instructor input	15	[a]

[a]This data was not available. However, we calculated the combined average of the two components to be about 80.

Several faculty members told us that they believed the Division Director and Academic Dean focused too much of their attention on how high the grades were in electrical engineering rather than on how well the midshipmen were performing. Faculty members continue to express concern that they are under pressure to give higher grades than are deserved. Several faculty members told us that they believed tenure decisions and performance ratings depended on the grades they gave and that job security for nontenured instructors could rest on their average grades. According to faculty members, the Division Director requested each instructor's interim grades throughout the semester and met with all new faculty to discuss, among other issues, the importance that midshipmen do well in electrical engineering. Faculty members told us that concerns about grading pressure had lowered morale.

We examined the grades given by individual instructors. We found that the ratio of Ds and Fs given by the newer instructors and the military instructors was approximately 10 percent less than that given by the tenured faculty.

Other Factors Potentially Bearing on Electrical Engineering Grades Merit Additional Consideration

Our examination of the various reviews of the problem of electrical engineering grades revealed several factors that we believe warrant additional consideration. One factor cited by the committee of educators was the lack of motivation among the midshipmen who saw the required electrical engineering courses as irrelevant to their careers, a perception that raises the question of whether the requirement is appropriate. Another factor mentioned by midshipmen, faculty, the former Chairman, and the committee of educators was the lack of time available for students to prepare and study for courses. A final factor is the relatively low priority placed on attending extra instruction in a table of priorities in an Academy regulation governing the use of midshipman time.

Alternatives to Requiring Electrical Engineering Not Evaluated

The CNO has issued guidance on the minimum professional core competencies for officer accession programs, including the Naval Academy, ROTC, and OCS programs. Part of this guidance requires that prospective officers be able to comprehend and apply the principles of electricity and electronics. However, among these primary programs, the requirement that all prospective Navy officers take electrical engineering courses is unique to the Academy, which produced about 13 percent of the Navy's newly commissioned officers in fiscal year 1990. The ROTC, which produced about 24 percent of the Navy's commissioned officers, and the OCS, which produced approximately 10 percent, have no similar graduation requirement. The ROTC Program allows that competency to be met by other courses, such as calculus-based physics. Since graduates of all the Navy's primary commissioning programs are assigned without regard to source of commission, we question whether requiring electrical engineering for Academy graduates is appropriate.

Although this question was not addressed as part of the earlier reviews, Academy officials told us that they had recently considered the requirement as part of a 1991 curriculum review and had concluded that the requirement was appropriate. The curriculum review considered only whether current Naval Academy courses met the guidance—not whether other courses could be designed or redesigned to meet the required core competencies. In addition, a 1990 curriculum review report noted that nearly all senior officers interviewed stated that the core curriculum contained substantially more electrical engineering material than was needed by well-trained officers in the fleet. According to Academy officials, several senior engineering faculty members will conduct a review of the minimum professional core competencies to

make an assessment of them and the Naval Academy's electrical engineering curriculum in the summer of 1991.

The Adequacy of Study Time

The adequacy of students' study time has been the subject of several reviews at the Academy over the last 5 years. As we noted in a recent review of the operations of the three DOD service academies,[1] the issue of inadequate study time has been brought up by accreditation bodies and visiting professors over the years. Despite the frequency with which this issue has been raised, it was not specifically addressed in the actions aimed at rectifying the problem with electrical engineering grades.

Responses to our 1990 Naval Academy surveys indicated widespread concern among midshipmen and faculty members that midshipmen lacked adequate study time. Around half of the 528 midshipmen and more than 60 percent of the 122 faculty members we surveyed expressed concern over not only inadequate time for academics but also insufficient time for all demands. Respondents also indicated that the midshipmen's schedule should be restructured to provide larger blocks of study time (see table III.3).

Table III.3: Responses to Questions Pertaining to the Adequacy of Time

Issue	Percent indicating agreement (and associated sampling error)	
	Midshipmen	Faculty
Midshipmen do not have sufficient time for academic studies	48 (4.0)	61 (7.7)
Midshipmen do not have sufficient time to satisfy all demands	55 (4.0)	65 (7.5)
Midshipmen's schedule should be restructured to provide larger blocks of study time	47 (4.0)	61 (7.7)

In the face of what they perceive as inadequate time, midshipmen are forced to prioritize their responsibilities and allocate their scarce time among the various demands. While this process may have merit in developing midshipmen's time management skills, it can also have some negative side effects in the academic area. One consequence is that midshipmen may put other responsibilities ahead of their studies and allocate too little time to academics.

[1] DOD Service Academies: Improved Cost and Performance Monitoring Needed (GAO/NSIAD-91-79, July 16, 1991).

Midshipmen and faculty responses to our survey indicate a widespread perception that nonacademic aspects of Academy life may take precedence over academics. As shown in table III.4, 70 percent of the midshipmen and 78 percent of the faculty we surveyed indicated that failing an inspection had more immediate consequences for a midshipman than failing a quiz. Also, 40 percent of the midshipmen (62 percent of the fourth class midshipmen) and 73 percent of the faculty we surveyed indicated that learning fourth class knowledge[2] took precedence over homework. Further, the 1990 Academy curriculum review noted that the pressures of satisfying the fourth class requirements leave too little time for freshmen to spend on academics.

Scarcity of time can also lead students to take shortcuts that limit the learning that takes place. About 68 percent of the midshipmen and 78 percent of the faculty in our survey indicated that, because of time limitations, midshipmen had to concentrate on adequacy rather than excellence. Also, 47 percent of the midshipmen and 39 percent of the faculty we surveyed indicated that for most courses it paid midshipmen to put more emphasis on short-term memorization than on trying to keep up throughout the semester. Scarcity of time is also seen as contributing to the temptation to cheat. Forty-two percent of midshipmen and 34 percent of the faculty we surveyed indicated that the pressure for academic success and the lack of adequate time could lead otherwise honorable midshipmen to cheat.

Table III.4: Responses Concerning the Consequences of Insufficient Time

Issue	Percent indicating agreement (and associated sampling error)	
	Midshipmen	Faculty
Failing an inspection has more immediate consequences than failing a quiz	70 (3.7)	78 (6.6)
Learning fourth class knowledge takes precedence over homework	40 (3.9)	73 (7.0)
Midshipmen have to concentrate on adequacy rather than on excellence	68 (3.7)	78 (6.6)
It pays to emphasize short-term memorization rather than keeping up throughout the semester	47 (4.0)	39 (7.7)
Pressure for academic success and lack of time could lead to cheating	42 (4.0)	34 (7.5)

Faculty comments on the write-in portion of the questionnaire cited the midshipmen's course loads as being too heavy and stated that their

[2]"Fourth class knowledge" refers to information on Academy and Navy operations, organization, and traditions required of Academy freshmen.

schedules should be better balanced between professional and academic demands. Several faculty members told us that instructors often reduced the academic demands they imposed to accommodate the midshipmen's fragmented schedules. Faculty comments also noted that many midshipmen assumed passive roles in their learning, and several reported that midshipmen often slept through their classes. We noted one or more midshipmen sleeping in each of the four electrical engineering classes we observed.

The Academy has recently initiated several steps aimed at assessing students' time. Since 1989, a Naval Academy faculty member has periodically collected data on the time midshipmen spend on academic, military, and physical activities. Also, in academic year 1990-91, the study time was increased by 45 minutes; the evening meal was changed to a buffet to permit midshipmen to better manage their own schedules for study in the evening; and there was an increased effort to ensure study time was uninterrupted by other activities. Additionally, a curriculum review was initiated. One of its aims was to reduce the number of academic hours required for graduation for each midshipmen by 8 to 10 hours.

Perceived Priority of Academics

A number of faculty cited an Academy environment in which academics were not perceived as a top priority by midshipmen, officers, and some members of the administration. Their perception of a relatively low priority placed on Academy academics is supported by the results of a 1989 Naval Academy study of minority midshipmen. The study found that participation in club sports, brigade support activities, and standing watch[3] adversely affected the ability of academically deficient midshipmen to prepare for classes and exams. The study recommended that the Academy prohibit midshipmen with unsatisfactory academic performance from participation in club sports and brigade support activities that interfere with study hours or cause absences from classes. Additionally, the study recommended that the Academy prohibit academically deficient midshipmen from standing watch and similar duties during academic-reserved periods and final examination review week.

The perception that the priority placed on Academy academics is relatively low is also reinforced by the Midshipmen Regulations, one of the

[3]Standing watch involves the performance of specific duties such as staffing corridor checkpoints and the midshipman information center.

key sets of regulations with which midshipmen must comply. The Midshipmen Regulations contain a list of 24 midshipmen activities in order of priority. Attending extra instruction sessions is ranked 23rd, following such activities as drills, intramural athletic activities, parades, march-on practice, and extra duty and restriction musters. In the previous order of priorities, attending extra instruction had been ranked above intramural athletic activities. Currently, the only activity with a lower priority than attending extra instruction is midshipman liberty.[4] The priority listing grants no exceptions to academically deficient midshipmen.

[4]Midshipmen liberty consists of short periods—of a weekend or less—of time off.

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